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The Safety-Net Role of Forest in Forest-Based Livelihoods in West Bengal

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Abstract
Do forest incomes matter in rural livelihoods as a safety net? In other words, do forest dependent households use forest resources to cope with a shock? If so, what type of shocks matter more? Is forest resource extraction a viable coping strategy? To address these queries, we draw on the *safety net* dimension of rural livelihoods and studied 372 households located in seven forest areas of West Bengal, India between December 2013 and December 2014 in different phases. Interestingly, we find that the poor households extract forest resources based more on necessity than on choice and consequently they are benefited more in relative terms while the non-poor derive forest benefits more in absolute sense. More importantly, we find that forest serves as a natural insurance. In time of crises, local people significantly increased forest resource extraction especially after a community-level shock. Further, we noticed that households that are (a) asset-poor, (b) young, (c) male-headed, (d) live far away from market, and (e) located close to forest tend to use forest resources more to cope with a shock. Moreover, households turn to forest more if they face community-level or co-variate shocks rather than idiosyncratic or personal shocks. Local forest user households also believe that *extraction of forest resources* is a low-cost coping strategy compared to the other major strategies (such as *reduction in consumption, asset depletion, reallocation of labour* and *outside help*). The implication is that conservation of forest is important for sustaining rural forest dependent households as forest serves as a shock absorber.

Keywords: West Bengal; forest resource use; safety nets.

Introduction

Forests provide various sources of rural livelihoods ranging from being a source of (new) agricultural land, to non-timber forest products (NTFPs), timber and also on-site ecological services. One in six persons globally depends on forests for basic subsistence needs, especially supplementary food (World Bank, 2004). However, different socio-economic groups use forest benefits in different ways and to different degrees. It is argued that forest income is relatively more important for poor people, and as a result, that forest degradation adversely affects the poor more often than other groups (Campbell and Luckert, 2002). More controversial argument asserts that the poor may be hurt more by strict rules of forest conservation (Angelsen and Wunder, 2003; Vedeld, 2002). The poorest segments of the societies around the world are also found to be the principal users of NTFPs (Neumann and Hirsch, 2000). A recent study on the global comparison of forest dependency shows that forest contributes about 22% of total household incomes and forest extraction and use activities stand as the third most earning activity (Vedeld *et al*., 2007). This importance of forest-based rural livelihood is nicely summarized in the World Bank report of 2004 that assessed that:

> "More than 1.6 billion people depend to varying degrees on forests for their livelihoods. About 60 million indigenous people are almost wholly dependent on forests. Some 350

million people who live within or adjacent to dense forests depend on them to a high degree for subsistence and income (World Bank, 2004: 16)."

All these above arguments and findings convey that forest conservation is essential for sustaining rural livelihoods. However, few studies have been conducted that examine the role of forest as a natural insurance especially in time of shocks and uncertainty. Whatever evidence exists, that is scattered and also concentrates either on poverty or on inequality. None of them explore role of forest as a safety-net. These studies therefore presents partial picture as regards the economic contributions of forest resources to rural livelihoods and hence lead to no uniform policy-related ideas.

Hence, an understanding of the economic importance of forest incomes/benefits[1] as a safety net is significant for effective policymaking, and also to the trade-offs and synergies between forest resources use and protection. This importance gives rise to the following principal research questions: Does forest resource use matter as safety net in rural livelihoods? Ribot and Peluso (2003) suggest that because of the different forms of mechanisms that stakeholders use in benefiting from things including natural resources, all groups or individuals may not be equally benefited. For that reason, and also to address the principal research questions posed above, we have assessed the impacts of forests resource use on the safety net dimension of rural livelihoods with respect to India's Joint forest management as a case study and further explored the following related queries that may impinge on the forest-based rural livelihoods: What is the nature of forest dependency of the poor households as compared to the non-poor: choice-based or necessity-based? To what extent forest incomes contribute to the incomes of the poor and the non-poor? Do the forest dependent people tend to use forest resources as safety nets more in time of shocks and crises? If so, what type of shocks make people more reliant on local forest commons? Does extraction of forest resources appear as a viable coping strategy? Which factors motivate people to increase extraction of forest products to cope with a shock? To know the answers of these queries is of considerable importance to natural resource based sustainable rural livelihoods (Ellis, 2000). By addressing the above-raised issues in the context of the Indian Province of West Bengal, this study extends the current discourse of community-based forestry and rural livelihoods.

2. Literature Review and Hypotheses

We draw mainly on the literatures linking distributive equity and sustainable commons management, and also those focusing on forest resource-based rural livelihoods. The former asserts that poor people extract more resources from the commons due to greater reliance on natural resources and also due to their high individual rate of time preference (Adhikari, 2005). Consequently, the poor adopt strategies that yield more immediate results (Holden *et al*., 1998).Further, some scholars have found that compared with the non-poor, the poor may depend more on the commons in relative terms, but in absolute terms their dependency is lower (Dasgupta, 1993). Due to asset constraints poor people extract more fuel wood and non timber forest resources which are also driven by their needs (Adhikari et al., 2004). On the other hand, Agarwal (2000) finds that rich or less poor people tend to derive cash income based benefits. Similar evidence was also found in Nepal (Adhiakri, 2005). In a more recent study, Mukherjee et

[1] In this research, we only consider the direct use values of forest resources associated with local consumptive uses, such as fuel wood, construction wood, fodder, timber, fruits, medicinal plants and so on.

al (2017) observe that poor tend to benefit less from local commons due to their low relative positioning in the forest dependent society (based on their low ability to influence others) and also find that status characteristics such as useful contacts, education etc more significantly affect poor people's benefits from forest than other factors. Hence these insights lead to the following hypothesis on households' forest resource use:

Hypothesis 1. Compared to the non-poor, the poor are more dependent on forest resources in relative terms and their forest dependency is also need-based.

The literature on forestry and rural livelihoods has further identified that forests contributes to rural livelihoods:

(a) By supporting current consumption or meeting a household's subsistence needs: Forest products are important to maintain the current level of consumption and prevent a household from falling into deeper poverty. This function has no or limited scope of lifting people out of poverty. This may be in the form of seasonal gap-filling and complements other incomes; regular subsistence uses; and/or low return cash activities.

(b) By providing valuable safety nets in times of emergency: Forest products are used to overcome unexpected income shortfalls or cash needs. This function refers to the role forests can play during periods of hardships (during the period of unpredictable irregular events that cause a temporary need for extra income).

(c) By providing a possible pathway out of poverty: Forest products provide a way to increase household income in a sustainable manner either via the accumulation of capital to move into other activities (a "stepping out" strategy) or intensification and specialization of existing activities (a "stepping up strategy").

Based on these roles, Reddy and Chakravarty (1999) find that in Indian villages overall poverty dramatically increases if forest incomes are ignored. In Ethiopia, Babulo et al (2009) note that the inclusion of forest income reduces the headcount poverty to 68%, with a relative drop of poverty by 21%.

By contrast, scholars like Godoy *et al.* (1998), Pattanayak and Sills (2001) and Wunder *et al.* (2014) have focused on the relationship between shocks and livelihoods. They contend that rural households adapt to shocks and uncertainties both *ex-ante* and *ex-post.* This literature identifies two types of shocks that affect rural livelihoods: (i) *covariate shocks (that exert community wide effects)* such as flood, elephant raiding and attack; crop failure due to heavy rains etc and (ii) *idiosyncratic shocks* which affect only individual or a few households such as illness, death, crop failure due to insects etc (Wunder *et al.,* 2014). For coping with those shocks, forest resources often are more important as an natural insurance both in cash and subsistence in the poverty-stricken areas than savings or credit access (Godoy *et al.,* 1998). The shock-related literature argues that as a safety net resource, forest provides especially the poor additional flexible options in times of trouble (Wunder *et al.,* 2014). Mainly rural households tend to increase extraction of non-timber and timber resources during their hardship. Evidence abounds. In time of agricultural and other types of shocks people were found to increase forest resource extractions (Pattanayak and Sills, 2001). In times of flood and other weather related shocks, large losses were made up for by forest land conversion to new crop lands and increasing extraction of resources (McSweeney, 2004; Debela e*t al.,* 2012). Household-level socio-economic factors also affect households' tendency to turn more to forest after a shock. For example, young households

in Honduras were found to sell forest resources more when crop failed (McSweeney, 2004). Since forest resource collection requires labour, the male-headed rather than the female-headed households enjoy greater availability of labour and thus tend to use forest after a shock more. Similarly, asset poor households will rely more on forest based strategies to cope with shocks. These findings and arguments result in hypotheses 3 and 4 below. While hypothesis 3 deals with the effect of shocks on forest resource extraction, hypothesis 4 relates to the determinants of after-shock forest resource use.

Hypothesis 2. To cope with a shock, households turn to forest more and increase extraction of forest resources before or after the shock and this is more so if they experience a covariate shock.

Hypothesis 3. Households that are: (a) younger, (b) male-headed, (c) asset-poor (in terms of education, land, and physical capital), (d) located close to forests, and (f) far away from markets tend to turn to forest more and increase resource extraction to cope with a shock.

3. Data collection and methods

3.1. Selection of forestry organizations and the study households

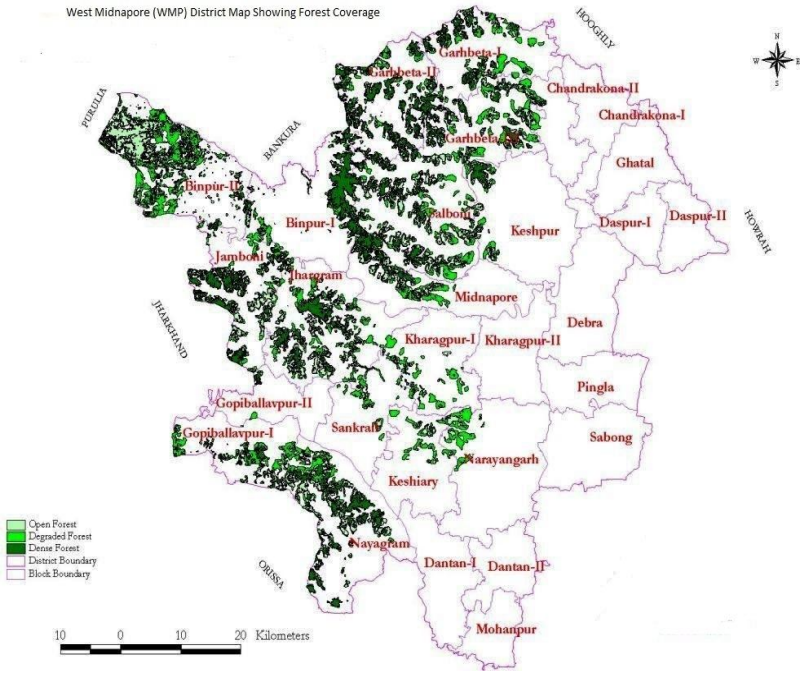
This study is based on the surveys administered between December 2013 and December 2014 respectively in a phased manner. Accordingly, we have followed a two-stage sampling technique in line with the above studies to select the joint forest management committees (JFMCs). Initially, a pilot survey was conducted and, based on the trends in forest conditions (defined later), we divided all the registered JFMCs of the study sites into three types: committees with *improving* forests, those with *stable* forests, and the organizations that have *declining* forests. Then, we chose every fourth committee from each of the three categories, resulting in 49 shortlisted JFMCs in such a way that the selected forestry organizations contain a minimum of 15 per cent of the total number and, among other dimensions, show diversities in: (1) extent of poor people's involvement in the decision-making body of the village forest protection committee (called Joint forest management committee or JFMC in brief), (2) conditions of the forest being managed by a JFMC, (3) area under the forest (4) the number of member households in the committees (5) (mainly negative) shocks and (6) household characteristics. Seven of these were randomly selected for survey. Of these, Panialguri, Poro-Basti and Kalkut-Cheko are located in the buffer zone of BTR (where JFM is practiced), represent the northern JFMCs, while Chharadhan, Mahuldanga, Salboni and Banschati, the southern JFMCs, are located in WMP.

For household-level surveys in the selected areas, every third household from the relatively large committees (with >50 members) and every second household from the smaller committees were chosen. We conducted interviews of only the heads of the sample households. Ultimately 372 heads participated in the surveys.

We prepared a comprehensive set of questions drawing heavily on the Poverty and Environment Network (PEN) resources.[2] Since regional diversity in our study is limited relative to the countries in the PEN studies (e.g., Angelsen and Wunder, 2003; Fischer, 2004; Vedeld *et al*., 2007; Babulo et al., 2009; Wunder *et al*., 2014) we included only those parts of their survey questions that we found relevant in our study areas. Alongside, we also collected qualitative and

[2] These are available at https://www.cifor.org/pen/

quantitative information to create a more relevant questionnaire. Further, conducted pilot surveys also fine-tuned the final set of questions that we used in our study.



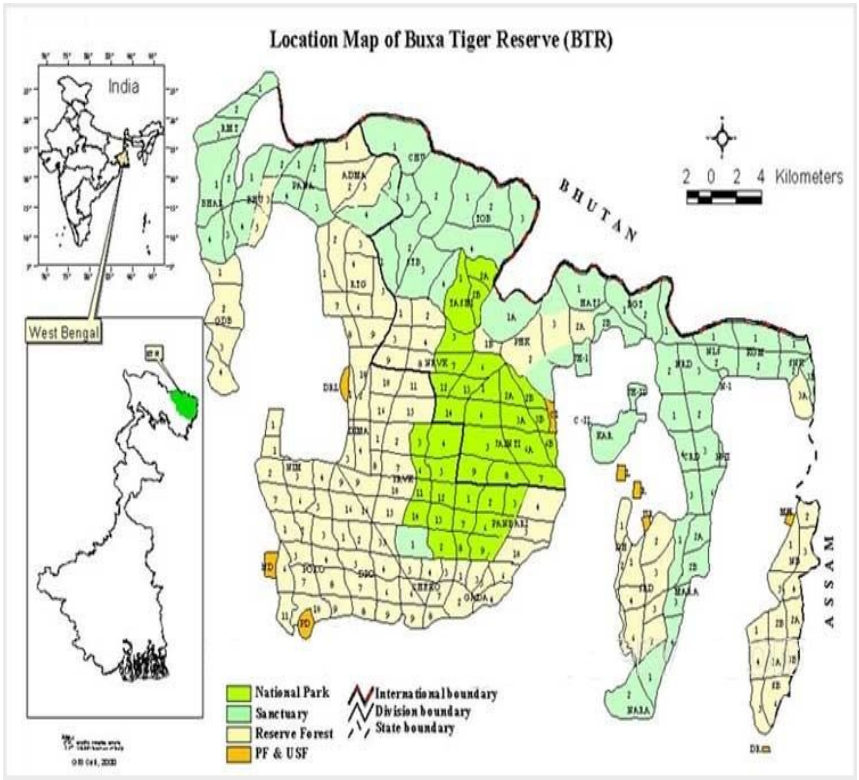


Figure 1. Maps of the study sites

5.2. Measuring key variables

Household's net income

Following Cavendish (2002), we adopt total net income (both income in cash and kind) approach in order to measure a household's income. For this, we consider five relevant sources of household-level incomes– crop, livestock, off-farm activities, forest resources and miscellaneous. We estimate households' incomes in the following manner:

1) Net crop income: Using the local market prices, values of different crops produced by each household over the year are calculated in order to derive gross crop income and input costs are deducted from the gross income to compute the net crop income.
2) Net livestock income: Livestock sales, products and services are the three major components of livestock income. We have used local market prices for valuation of the first two components, while livestock services like transport are evaluated using imputed values. The sum of these components results in gross livestock income. The total costs of livestock production (e.g., cost of fodder etc.) are deducted from gross livestock income to derive the net income from livestock. We computed these for all the surveyed households.
3) Off-farm income: Daily wage employment, different business activities, petty trade are the major components of off farm activities. In our study areas, a large number of households participate in 100 days' work under National Rural Employment Guarantee Scheme (NREGS) of the government of India involving labor employment in village-level public works and receive cash income in return. The net income from these and the related activities is defined as off farm income.
4) Forest income: Since no official data on household-level forest resource uses exists in the State of West Bengal and also in the study areas, we resorted to each household's self-reports on the quantities of forest products gathered weekly for consumption, sales or exchange and accordingly estimated the forest incomes of the sampled households using the prevailing local market prices. The details of the calculations of forest incomes are described later.
5) Miscellaneous income: Earnings from different other sources such as, net interest on money lent, rent income from land, remittances (if any) were also aggregated to obtain 'miscellaneous income.

A household's gross income is the sum of incomes from these sources. Net incomes are obtained by deducting the associated costs as described above.

Gross and net forest incomes

As practiced in the literature (e.g., Adhikari, 2005) we computed household-level benefits from the local (co-managed) forests on the basis of the market values of the harvested forest products. Of the many possible forms of forest resources, we found fuel wood, fodder and leaf litters contributing significantly to local livelihood. In this context, we followed the underlying steps to estimate the forest income of the forest-reliant households.

Gross incomes from forest

We, following Adhikari (2005), estimated gross benefit/income from forest products by the quantity of actual harvested products times the product price less of all costs, including imputed costs of labour. We used different approaches to calculate the value of forest products. For instance, we adopted village-level retail price to value firewood used at home. We computed the benefits from non-marketed NTFPs, tree, grass and fodder applying the technique of *barter game* as previously used by researchers like Adhikari (2005). In this exercise, some arbitrarily chosen respondents in each FPC were divided into fictitious buyers and sellers. Buyers were instructed to buy forest products in lieu of a locally exchanged commodity with a well-established market price. We offered buyers a bag full of rice, and the sellers a head load of fodder. The participants were given the opportunity to discuss among their group members about the appropriate exchange rate between rice and forest products. The final exchange took place based on a consensus arrived at among all members of a group. This equilibrium exchange rate prevailed across all the villages under consideration but differed between the products. The value of leaf litter was estimated on the basis of the time cost incurred while gathering and transporting a head load of leaf litter from the forest to house. We considered the yearly mean wage rate due to seasonality of local-level wage rates. To ensure the accuracy of the information thus gathered, we also cross-checked with the local foresters and experts.

Forest net incomes

Forest net incomes refer to revenues less resource appropriation costs that are mainly opportunity costs of labour, the cost involved with tools and equipments, and their depreciation (see Adhikari 2005). So the resource appropriation costs in this study take into account opportunity costs of time involved in identifying, harvesting, processing, and bringing the harvested resource from the forest to house. They also include the cost of tools and equipments (inclusive of depreciation), and transaction costs[3] borne by households. We also collected data on ownership of tools and equipments employed for such purpose, their costs as well as economic life, and the share utilized for forestry activities. Thus, we derived the aggregate costs of tools and equipments. To arrive at the net income from forest use we derived gross income (as mentioned above) less of imputed costs and transaction costs.

Empirical Strategies

In this section, we analyze the role of forest as a safety net in the livelihoods of the surveyed households. For this purpose, we assume that different types of shocks and their severity, and also assets, income class and other socio-economic characteristics of the surveyed households are important determinants of a household's increase in forest extraction after a shock. To this end, we adopted a Probit model and call the estimated equation as the 'safety net equation'. This is given as

Prob [Use of *forest resources to cope with a shock = 1 if Yes*] *=F(constant, shock-related variables, households' other characteristics)* (1)

Formally, (8) can be rewritten as

[3]Transaction costs are defined as the costs of defining, protecting and enforcing the property rights to goods and services (Ray and Bhattacharya, 2011). In natural resource co-management, we measure it as the number of labor days spent in obligatory forestry activities like information gathering and sharing, implementing and monitoring of conservation activities, attendance at the JFM meetings and conflict resolution for managing local forest..

$$TF_{ik} = \beta_0 + \beta_1 X_{ik} + \beta_2 X'_{ik} + \varepsilon_{ik} \quad (2)$$

In equation (2), i indexes the household i in JFMC k. The dependent variable TF_{ik} is a binary variable and is equal to 1 if the household i, who is a member of k^{th} JFMC or village, turn to forest and increases forest resource extraction after a shock and 0 otherwise.[4] ε_{ik} is an error term. X_{ik} is the vector of shock related variables such as type and severity of shocks. Here we consider only the negative shocks in congruence with the livelihood-related shock literature. X'_{ik} represents the vectors of the surveyed households' other characteristics as well as relevant contextual characteristics of the region where the households are located such as household's distance to the nearest health centre, average rainfall of region and the like. We assume that these factors influence a household's turning to forest more and increase in forest uses after a shock. The overview of the variables along with the regression analysis is described later.

4. Results

4.1. Household Characteristics

Characteristics of the surveyed households, reported in table 1, reveal socio-economic heterogeneity across the different income groups. The poor households significantly differ from

Table 1.Socio-economic characteristics of the studied households

Variables	All sample (n = 372)	Poor (n=275)	Non-poor (n=97)	p-value (between poor and non-poor)
Male-headed households (in %)	55.11	45.45	84.84	
Female-headed households (in %)	44.89	54.55	16.16	
Caste: General (Upper caste) Reserved	 72 300	 34 241	 38 59	
Age of the respondent (in years)	43.56 (27.95)	43.97(25.42)	42.40 (34.09)	0.651
Household Size (number of members in the households)	5.7(4.27)	6.91(4.97)	5.70 (3.08)	0.025
Landholding (in acres per households)	1.94 (1.56)	1.07 (.44)	4.41 (.72)	0.0001
education (Average school years of the household head)	4.84(4.11)	3.72(2.55)	6.46 (6.39)	0.0001

[4]Eq. (2) is restricted to those households that have faced shocks at least once in the last one year. Since 38 households did not report any shock that they have faced during the mentioned period, the sample size for the estimation reduces to 334.

Average livestock units owned	2.85(2.7)	1.82 (2.12)	5.78 (1.91)	0.0001
Average annual non-forest income per capita (in INR)	19720.13 (17645.05)	9350 (1198.10)	49120 (4553.34)	0.0001

Note: 1.The latest poverty line in rural areas of West Bengal is Rs. 783 per capita per month or 26 rupees per day per capita in 2011-2012. 22.52% people in the rural areas of West Bengal are BPL.Source: http://planningcommission.nic.in/news/pre_pov2307.pdf

2. Figures in the parentheses represent standard deviations.

The non-poor in terms of land and livestock holdings, fewer opportunities resulting in lower non-forest incomes. One of the reasons might be that the poor are less educated (this table). Thus, evidence in table 1 suggests that poor households in the study areas are fairly asset- and income constrained.

4.2. Forest products collection by the poor and the non-poor

Table 2 presents the nature of forest dependency of the local studied households belonging to the seven villages. Overall, fuel wood and fodder appear to be the most important forest products in the livelihoods of the locals. However, disaggregating the data further, we notice sharp differences in product preferences between the poor and the non-poor income groups. The former group appropriates fuel wood, food items, sal seeds as well as the similar products significantly greater than the latter group. These resources, according to Agarwal (2000), are immediate and everyday in use. By contrast, the less poor households tend to extract mostly grass and fodder items, almost double the quantities harvested by the poor annually. Moreover, we expected the poor to collect firewood significantly more than the non- poor but the data in Table 2 do not substantiate this. Our observation is that product-wise almost every household has a major share of their stake in terms of fire wood and so, the non-poor members of the surveyed forest protection groups tend to retain their fire wood stake, may be due to either their century-old practice or neighbourhood effect (Wunder *et al.,* 2014) or more importantly to remain actively involved in protection and use of the forests in order to keep control over the forestry-related decision-making process (Ray and Bhattacharya, 2011) or all of these. For example, Wunder *et al.* (2014) find that irrespective of their needs people tend more to extract forest environmental resources when they see other neighbors doing the same and they coin this as *neighborhood effect*. In the study sites, based on our interactions with some of the non-poor villagers of Panialguri village we believe that more rich/non-poor households do not always use

Table 2. Annual average forest product collection by income

	All sample	Poor	Non-poor	t-statistic	p-value
Fuel wood (in kg)	556.89 (435.03)	581.50 (411.43)	487.12 (489.20)	1.85	0.0657
Grass and fodder (in kg)	108.99 (119.70)	88.69 (98.56)	166.55 (151.42)	5.75	0.0001
Leaf Litter (in bundle)	88.98 (87.22)	92.78 (92.23)	78.20 (70.03)	1.42	0.1568
Sal seeds, kendu leaves, medicinal	223.97 (180.60)	241.09 (193.91)	175.45 (123.68)	3.12	0.0020

plants (in kg)					
Sal leaves (in bundle)	145.07 (112.35)	155.24 (119.65)	116.22 (81.82)	2.98	0.0031
Food items and ritual items (in kg)	50.56 (48.56)	54.37 (50.40)	39.76 (41.02)	2.57	0.0106

Note: Standard deviations are presented in parentheses.

Fire wood only for domestic consumption but also sell them for additional earnings especially in festive times. In a nutshell, while the poor households extract resources as per their needs, the non-poor households' forest dependency seems to be choice-based since they could have purchased fodder and firewood from the markets. That the non-poor are more asset- and income-rich (Table 1) bolsters the above proposition. Adhikari (2005) also noted similar preferences of the local forest-reliant households in the context of Nepalese community forestry.

4.3. *Forest contributions to local livelihoods*

4.3.1. *Forest dependence of the surveyed households*

Are all the studied households equally benefited from the local co-managed forests? Table 3 provides a set of plausible answers. Overall, 372 households derive 17,230 Indian Rupees (INR) on an average annually from the local forests. To examine whether non-linear relationship exists between the income groups and forest incomes, we divided the non-poor households further into those that hold above-average land and those having below-average lands. We define the former households as the *rich* group and the latter as the middle-income group. Given this classification, we see that the rich appear to be the most benefited in absolute terms and their forest incomes are almost double that of the poorer households. On the other hand, poor households derive least benefits. However, the middle-income households are no less benefited than the rich. Plausibly, though intermediate forest products like fodder and leaf litter constitute a major share of household-level income in South Asia (see Adhikari et al., 2004; Mukherjee et al., 2017), the poor cannot use them due to their limited assets. In contrast, besides firewood collection the relatively rich farmers graze more animals, collect tree and leaf fodder, and sell milk. All of these have good market opportunities (see Jodha, 1995).

However, net income from forest seems to demonstrate an increasing trend up to a certain income and then it drastically declines. This may be due to the higher opportunity costs facing the rich in earning incomes from local forests. As a result, the shares of gross and net forest incomes are higher for the poor, while the middle income group seems to be in a best position because they are the only group who are deriving greater benefits both in absolute and relative terms. Elsewhere, similar patterns of forest reliance are noticed (e.g., Adhikari, 2005). Perhaps, the subsistence forest activities are more attractive to the poor and the landless due to their limited livelihood alternatives.

Table 3. Absolute and relative forest dependence per household per annum(in Indian Rupees)

Income groups	Number of households	Gross forest income	Net forest income	Share of gross forest income in total income	Share of net forest income in total income
Poor	275	14121	9564	23.10	15.65

Non-poor with below average landholding[a]	70	25343	18550	19.55	14.31
Non-poor with above average landholding[a]	27	26592	10080	14.01	5.31
All sample	372	17230.6	10386.86	20.56	13.55

Note: [a]: The average operational landholding (6.34 acres) of the non-poor households is considered for this classification.

4.3.3. Forest use as safety-nets in time of shocks

Table 6. Shocks confronting the study households

	Households surveyed	Number of shock reported	Households affected by shocks	Percentage of households affected by shocks	Total shocks per households	% of covariate shocks reported	% of idiosyncratic shocks reported
Poor	275	397	268	97.45	1.48	78.59	53.40
Non-poor with above average landholding	70	57	53	75.71	1.08	71.93	28.07
Non-poor with below average landholding	27	15	13	48.15	1.15	86.67	13.33
All sample	372	469	334	89.78	1.40	78.04	49.04

Table 6 reports various types of shocks that the sampled households faced in the last one year in time of the survey. 90 percent of the households reported that they have experienced at least one type of shocks and it is the poor that have faced shocks more often than the other two income classes. Expectedly, people reported covariate shocks more often as those shocks affect the entire community. Such shocks appeared in the study areas mainly in the forms of crop damages by wild animals (mostly by elephants), and crop failure due to heavy rains or flood. By contrast, the rich tend to report idiosyncratic shocks least of all income groups. It was quite expected as the richer sections of the study areas seem to have more viable coping strategies unlike the landless and the marginal households (Wunder *at al.,* 2014). However, respondents were found to be concerned more with the covariate shocks rather than the idiosyncratic labour shocks and of all households, the poor tend to be affected most adversely.

Table 7 reveals the types of shocks affecting the local households in the study areas. Among the covariate shocks, serious crop failure, mainly due to rains and flood and elephants'

raiding of crops are more common and are considered by the locals as most concerning. Of the idiosyncratic shocks, illness and/or death of the working members of a family appear to be reported most often. Based on the reports of the respondents we altogether identified 11 different types of shocks and of them, irrespective of their nature, crop damages and crop failure, and the labor shocks appear to be most threatening to the local livelihoods. The affected households reason that these shocks exert more immediate and adverse impacts on their incomes. Our findings are also in congruence with other studies (e.g., Fisher, 2004).

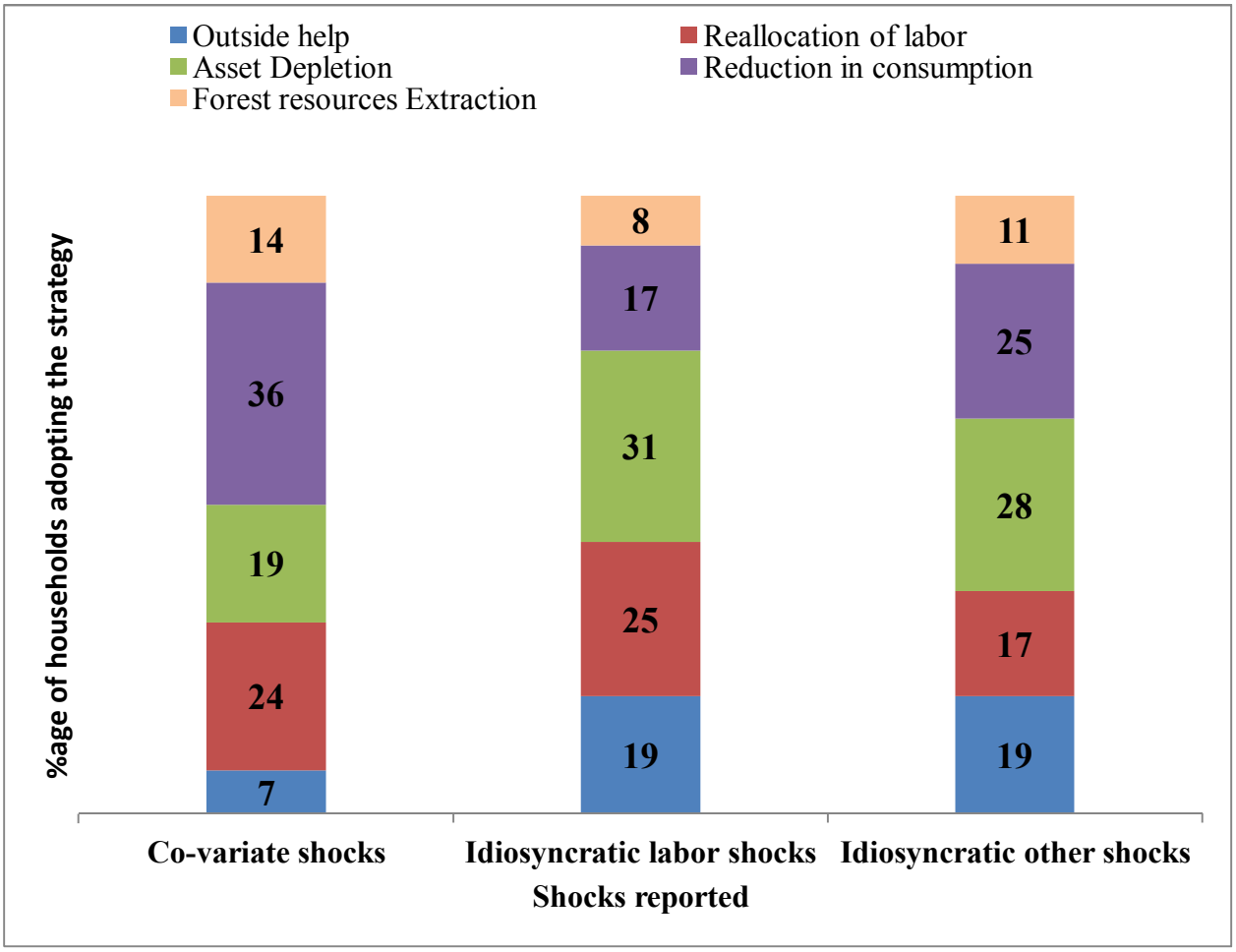
Table 7. Different types of shocks experienced by the surveyed households during the last 12 months in the study areas

Type of shocks	North Bengal	South Bengal	All sample
Covariate shocks			
Serious crop failure due to heavy rains (and flood)	48.60	31.61	39.78
Crop damage due to elephants' raiding	44.13	25.39	34.41
Livestock loss (due to animal attacks/flood etc)	10.61	1.04	5.65
Other major asset loss/damage	10.06	7.25	8.60
Labor (idiosyncratic) shocks			
Serious Illness of the family member(s)	14.53	11.40	12.90
Death of earning member/productive adult of the family	1.12	1.04	1.08
Other idiosyncratic shocks			
Loss of (daily) wage employment	6.15	7.77	6.99
Delays in receiving payments	7.26	12.44	9.95
Others	6.15	7.25	6.72
Number of households	179	193	372

4.3.4. Is forest resource extraction a viable coping strategy?

Figure 1 presents a comparative analysis of the different coping strategies that the local forest users more often adopt after a shock. Based on participatory appraisal technique, we could identify 21 different strategies that help the affected households to cope with the shocks and finally considered five of them as important because these were mentioned by almost all the sample households. From figure 1 we note that irrespective of the nature of the shocks, in order to fight against them, people tend to adopt *reduction in consumption*, *asset depletion* in the forms of selling lands, cattle etc., *reallocation of labor* to immediate income-generating activities and *outside help*. *Extraction of forest resources* seems to be the least attractive strategy compared to the above four.

Figure 1. Coping strategies of the shock-affected households



However, a cost-benefit analysis of adopting these strategies is essential to better understand the role of forest as a shock absorber. To do that, we describe the perceptions of the affected households in table 8. Clearly, significant differences in perceptions about the relative (dis)advantages of the coping strategies exist between poor and non-poor households. Poor households perceive that they deplete their assets (if any) or reduce their consumption level mostly by force and due to their necessity. Furthermore, they believe that redeployment of labor is not fruitful to earn wages and also uncertain for wage earnings. We reason that they do not seem to have any strong outside network. As a consequence, outside help is also difficult for them to get. Some scholars like Mukherjee et al (2017) have seen that the poor, marginalized and the landless classes get less help because they have low ability to influence others. By contrast, both the poor and the rich sections of the studied villages believe that forest access is easy, immediate and less constrained and this is more so in time of natural calamities. In this context, the account of a villager of Poro-Basti is worth mentioning here:

> "When heavy rain/flood takes place, we do not have any shelter and food. Our farm lands get inundated. Then we use timber that we generally gather from the local forest before the rainy season or after flood is over in order to erect a new or sometimes a damaged house. We have either very small lands or fewer cattle or neither of the two. So we cannot sell these because crop damages, floods and elephants' attacks recur almost in

every year. Besides, outside helps are very much conditional. We save the forests round the year and in return these forests save us after these."

(The head of a Rava household, PoroBasti).

Hence comparatively forest resource extraction is a low-cost coping strategy than the top ranked strategies such as reallocation of labor. This enables us to anticipate that resource dependent households tend to use more resources of the forests before or after a shock to cope with the shock. This is examined in table 9 below.

Table 8. Local people's perceptions about the coping strategies

Non-forest coping strategies	Poor	Non-poor	All sample
Reduction in consumption			
Necessity-driven	97.09	57.73	86.83
Choice-driven	0.00	42.27	11.02
Asset depletion			
Necessity-driven	61.45	40.21	55.91
Choice-driven	4.36	51.55	16.67
Redeployment of labor			
Uncertain	72.73	13.40	57.26
Certain	11.27	84.54	30.38
Outside network-based help			
difficult to get	64.73	19.59	52.96
Easy to get	14.18	62.89	26.88
Forest resource extraction as a coping strategy			
Access to forest resources			
Immediate	92.36	89.69	91.67
Constrained	7.64	0.00	5.65
Not needed	0.00	10.31	2.69
Timber access in time of shocks			
Constrained	28.73	30.93	29.30
Unconstrained	45.82	41.24	44.62
Not needed	12.36	27.84	16.40
Sales of forest resources			
Immediate	42.91	27.84	38.98
Constrained	28.36	12.37	24.19
Not needed	6.18	51.55	18.01
Number of households surveyed	275	97	372

Note: In some cells the percentages add up to less than 100. It is because the perception questionnaire contained "No response" as an answer option and we do not present them here.

4.3.5. Determinants of forest resources extraction as a coping strategy

The results of logit regression analysis presented in Table 9 shows some of the possible determinants of households' uses of forest resources to cope with a shock. Clearly, shocks matter

in using forests as safety nets. Especially, the covariate shocks compel households to use forest resources more while idiosyncratic shocks reduce forest resource uses. The reason may be that extraction and uses of forest resources is labour-intensive. When the shocks are severe, the surveyed households tend to extract forest resources more.

Of the household characteristics, age of the household head, income level, asset variables and neighbourhood variables are important determinants of forest as safety nets. Households that are young, less educated, poor, have smaller amount of lands and also have no access to credits use forest resources more. Moreover, land holding (as asset) tends to have non-linear relationship with use of forest resources. Landed households use forest resources less. As land size increases, after a certain size people tend to use forest products more but insignificantly.

Apart from these, households with strong social capital tend to depend on friends, relatives and fellow villagers for help and hence turn to forest less. We also see that the coefficients associated with the variables 'forest shares of other villagers' and 'Index of diversity of forest product collection by neighbours' are both positive and also statistically significant.

Table 9. Factors affecting households' greater use of forest resources as a safety net

(Dependent variable: "a household used forest resources to cope with a shock – yes = 1, otherwise = 0")

Variables	measurement	Expected sign	The regression results		
			Model 1	Model 2	Model 3
			Coeff(SE)	Coeff(SE)	Coeff(SE)
Shock variables					
Covariate shocks	(Yes=1, 0= otherwise)	+	.91(.21)***		1.06(.26)***
Labor shock	(Yes=1, 0= otherwise)	-	-.94(.24)***		-1.25(.3)***
Shock severity	(severe = 1, moderate = 0)	+	.45(.20)**		.60(.25)**
Household Characteristics					
Age of the household head	In years	-		-.03(.01)***	-.037(.008)***
Household size	Number of family members	+		.076(.057)	.56(.48)
Male heads	=1, 0 if the head of the is a female	+		.23(.21)	.44(.32)
Member of the dominant caste group	1 if yes, 0 otherwise	+/-		.65(.37)*	.67(.39)*
Income poor	If the household belongs to	+		.87(.40)**	1.01(.37)***

	poor income group= 1				
Education of household head	(in school years)	-		-.95(.33)***	-.89(.44)**
Land holding per capita	(in acres)	-		-.058(.027)**	-.037(.018)**
Land holding per capita(squared)		Na		.003(.003)	.024(.013)*
Livestock	in cattle unit	-		.96(.49)*	-.45(.27)
Trust villagers	Yes = 1	-		-.42(.21)**	--.35(.16)**
Forest share of other villagers		+		.58(0.2)***	.22(.1)**
Index of diversity of forest product collection by neighbour		+		.09(.04)**	.078(.42)*
Household distance to forest	In km	-		.2(.3)	-.013(.014)
Household distance to Market	In km	+		.3(.17)*	.28(.13)**
Household distance to primary health centre	Yes =1			-.03(.04)	.007(.005)
Access to credit	Yes =1			-.01(.005)**	-.024(.011)**
North Bengal household	Yes =1, 0 if the household belongs to South Bengal			.04(.3)	.61(.33)*
Intercept			.60(.27)**	-2.9(.2)***	.73(.78)
Model fit			Prob>chi^2=.0000	Prob>chi^2=.0000	Prob>chi^2=.0000
Pseudo R^2			.20	.12	.27

Note: N= 334; data are restricted for those households that experienced at least one shock during the last 12 months; *, ** and *** imply significance levels at 10, 5 and 1% respectively.

These results suggest that when other households derive more and diverse resources from forests, a household tend to increase forest extraction more due to the neighbourhood effects.

In short, majority of the variables have their expected effects on the dependent variable and these results seem to be consistent with other works like that of Wunder *et al* (2014) and Fisher (2004). It may be noted that we considered here only the impacts of negative shocks as we believe that such shocks adversely affect both the resilience (ability to withstand shocks) of forest protection communities and their livelihoods.

5. Conclusions

Access to forest resources is important for sustaining rural livelihoods. However, due to a little and scattered evidence, our knowledge regarding how forest serves as a safety net in resource dependent communities is incomplete. This drawback encourages the current study to explore the principal query on the commons: *Does forest matter as a safety net in rural livelihoods?*

To explore a plausible answer of this query we focused on the *safety-net* dimensions of rural livelihoods and chose community-managed forest areas as a case study because it is the co-management of natural resources under which households are granted access to forest resources and such access impacts their livelihoods unlike the protected area management model. Towards this end, we posit that *forest resource extraction for sales and/or domestic uses serves as a shock absorber in time of shocks and uncertainty.* To test this main hypothesis, we then relied on a few side hypotheses embedded in it and surveyed 372 households of seven villages located in the forest belts of Alipurduar (earlier belonging to Jalpaiguri district) and West Midnapore districts of West Bengal, India in different phases between December 2013 and December, 2014.

Important results emerge from the present study. In time of community-level/covariate shocks rural households turn more to forest and increase extraction of forest resources to cope with the calamities since they believe that extraction of forest resources is a safe and low-cost option. Ray et al (2017) note that these effects have a direct bearing on the sustainable use of the local forest commons. In villages, where households are more equally benefitted from local forest, people draw on forest in times of shocks are more likely to use forest sustainably. Thus, the results of our study support the principal hypothesis that forest incomes matter in rural livelihoods as a safety net resource.

This study has contributed to the current literature on forest-based livelihoods by showing that even in time of uncertainties arising out of shocks; forest helps rural households to make up for their income shortfall. The practical implication is that while making forest management policy, forest incomes should be considered as considered as a natural insurance in order to evaluate the important contribution of forest resources to the forest-based livelihoods of the rural households. Otherwise policy interventions may be misleading in improving rural livelihoods. More research is, however, needed to provide more robust conclusion on the issues raised here as our study has a limited diversity.

References

Adhikari, B., Di Falco, S., & Lovett, J. C. (2004). Household characteristics and forest dependency: Evidence from community-based forest management in Nepal. *Ecological Economics*, 48(2), 245–257.

Adhikari, B. (2005), 'Poverty, property rights and collective action: understanding the distributive aspects of common property resource management', *Environment and Development Economics* 10: 7–31.

Agarwal, B. (2000). Conceptualising environmental collective action: why gender matters. *Cambridge Journal of Economics*, 2000(24), 283-310.

Angelsen, A., Wunder, S., 2003.Exploring the forest-poverty link: key concepts, issues and research implications. Occasional Paper, vol. 40.Center for International Forestry Research, Bogor, Indonesia.

Babulo, B., Muys, B., Nega, F., Tollens, E., Nyssen, J., Deckers, J., Mathijs, E., 2009.The economic contribution of forest resource use to rural livelihoods in Tigray, Northern Ethiopia. Forest Policy and Economics 11, 109–117.

Campbell, B.M., Luckert, M.K. (Eds.), 2002. Uncovering the hidden harvest.Valuation Methods for Woodlands and Forest Resources. Earthscan, London.

Cavendish, W., 2002.Quantitative methods for estimating the economic value of resource use to rural households. In: Campbell, M.B., Luckert, K.M. (Eds.), Uncovering the Hidden Harvest: Valuation Methods for Woodland and Forest Resources. Earthscan publications Ltd., London.

Dasgupta, P. (1993), *An Inquiry into Well-Being and Destitution,* Oxford: Clarendon Press.

Debela, B. L., Shively, G., Angelsen, A., &Wik, M. (2012). Economic shocks, diversification and forest use in Uganda. Land Economics, 88(1), 139–154.

Ellis, F., 2000.Rural Livelihoods and Diversity in Developing Countries. Oxford University Press, Oxford.

Fisher, M., 2004. Household welfare and forest dependence in Southern Malawi.Environ. Dev. Econ. 9 (2), 135–154.

Godoy, R., M. Jacobson, J. de Castro, V. Aliaga, J. Romreo, and A. Davis (1998), 'Therole of tenure security and private time preference in Neotropical deforestation', *Land Economics* **74**: 162–170.

Holden, S., B. Shiferaw, and M.Wik (1998), 'Poverty, market imperfections and time preferences: of relevance for environmental policy?', *Environment and Development Economics* **3**: 105–130.

Jodha, N.S. (1995), 'Studying common property resources, biography of a research project', *Economic and Political Weekly* **30**: 556–559.

McSweeney, K. (2004). Forest product sale as natural insurance: The effects of household characteristics and the nature of shock in Eastern Honduras. Society and Natural Resources, 17(1), 39–56.

Mukherjee, P., B. Ray, and R.N. Bhattacharya (2017), 'Status differences in collective action and forest benefits: evidence from joint forest management in India', *Environment Development and Sustainability*; 19(5).1831-1854.

Neumann, R.P., Hirsch, E., 2000. Commercialisation of Non-timber Forest Products: Review and Analysis of Research. Bogor, Indonesia, and Rome: Center for International Forestry Research and Food and Agriculture Organization.

Pattanayak, S. K., & Sills, E. O. (2001). Do tropical forests provide natural insurance? The microeconomics of non-timber forest product collection in the Brazilian Amazon. Land Economics, 77(4), 595–612.

Reddy, S.R., Chakravarty, S.P., 1999. Forest dependence and income distribution in subsistence economy: evidence from India. World Dev. 27 (7), 1141–1149.

Ribot , J.C. and Peluso, N.L. (2003). A Theory of Access. *Rural Sociology* 68(2), 2003, pp. 153–181.

Ray, B., & Bhattacharya, R. N. (2011). Transaction costs, collective action and survival of heterogeneous co-management institutions: Case study of forest management organisations in West Bengal, India. *Journal of Development Studies*, 47, 253-273.

Varughese, G. and E. Ostrom (2001), 'The contested role of heterogeneity in collective action: some evidence from community forestry in Nepal', *World Development* **29**: 747–765.

Vedeld, P., 2002. The process of institution-building to facilitate local biodiversity management. Noragric Working Paper, vol. 26. Agricultural University of Norway.

Vedeld, P., Angelsen, A., Bojø, J., Sjaastad, E., Kobugabe, G.K., 2007. Forest Environmental Incomes and the Rural Poor, World Development, 9(7) Elsevier, pp. 869–879 (2007).

World Bank, 2004. Sustaining Forests: A Development Strategy. WB, Washington

Wunder, S., Börner, S., Shively, G.,Wyman, M., 2014. Safety nets, gap filling and forests: a global-comparative perspective. World Dev. 64, 29–42.